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Elizabeth Haines

Royal Holloway, University of London and Science Museum, London

elizabeth.haines.2011@live.rhul.ac.uk

'Pledging the future': investment, risks and rewards in the topographic mapping of Northern Rhodesia, 1928-1955

1.1 Abstract

This article explores the uneven patterns of topographic mapping of colonial Northern Rhodesia (today Zambia). These patterns were generated in the years 1927-1931 and have an enduring effect today. Previous accounts describe colonial mapping in Africa as 'incomplete', but this is an inadequate conclusion. The article proposes that these unsatisfactory narratives of cartography can be corrected by applying the model of a *cartographic economy* to the close reading of archival sources. This model is used to interrogate topographic unevenness within the framework of the interests of diverse parties, with differing values and resources. It reveals that the patterns of topographic production were particularly strongly linked to aerial photographic projects. These projects documented areas that were preconceived as valuable. However the article reveals that the cartographic economy was determined by more than just the value of the land, as the value of the cartographic representation itself could be manipulated independently. This perspective should be considered in the study of British mapping of other colonial territories.

1.2 Introduction

The question this paper addresses is encapsulated in Figure 1, a representation of the radically uneven production of topographic mapping at 1:250,000 in the British African colony of Northern Rhodesia (today's Zambia).¹ This schema shows that parts of the territory were

¹ Northern Rhodesia was under British crown rule between 1924 and 1964. However from 1953 onwards the colony was part of a conglomerated territory, the Federation of Rhodesias and Nyasaland. Responsibility for topographic production was transferred to the Federation in 1955, and was organized under federal authority until Zambian independence in 1964. Figure 1 only depicts the topographic maps produced by the Northern Rhodesian Survey Department, thus before 1955.

mapped at very different densities of detail. For certain areas topography was drawn up from aerial photography; for others it was drawn up with much sparser information from land-based survey. Up until 1955, a significant proportion of the colony saw *no mapping at that scale at all*. 1:250,000 was considered to the minimum necessary scale for governance, yet mapping at 1:500,000 (a scale at which entire Benelux region could be represented on a single sheet) was the most detailed published mapping available to many local administrators during colonial rule, particularly in the West of the colony.² The unevenness generated at that time has remained the status quo.³ Patterns of knowledge, and absence of knowledge, persisted largely intact in the print publication of maps throughout the twentieth century, and continue to be reflected in the geo-coding of satellite data. Anecdotally, this situation is familiar, but it has not been adequately addressed by literature on the role of cartography in twentieth-century state formation and governance. This article proposes a new mode of analysis to explore this cartographic heterogeneity. It proposes that the necessity (even the relative usefulness) of topography to the colonial state cannot be taken for granted. We return to the archives to ask under what circumstances topographic maps were considered to be worth producing, and whose interests determined that 'worth'.

² Mapping was produced for some areas at a larger scale, this was only occasional until the 1950s.

³ From 1946 mapping of certain areas of Northern Rhodesia was at 1:50,000 produced by a further agency, the Directorate of Colonial Surveys (DCS). The work of the DCS is not discussed here, but conformed to the pattern of unevenness for more than another decade, during which time it was tightly tied to high capital development projects (Macdonald, 1996).

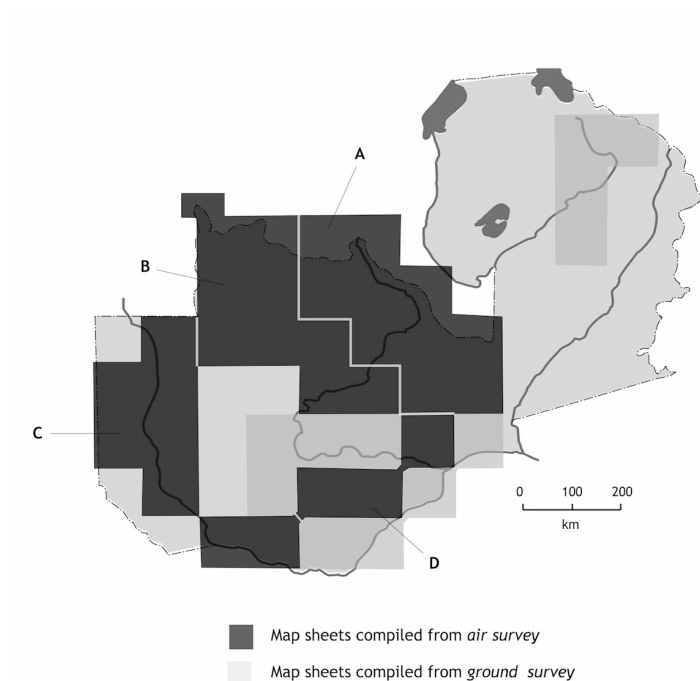


Figure 1: Distribution of map sheets at 1:250,000 compiled by the Survey Department of Northern Rhodesia, 1928-1955 (Pullan, 1978)

This position breaks strongly from prevailing conceptualisations of state topography. Amongst the variety of forms that state visualisations can take, topography has a privileged status since it forms the ‘base map’ or geographical index for a much broader range governmental projects: whether the organisation of cadastral records; the notation of vegetable, mineral, animal, and water resources; or the analysis of demographic data (Monmonier, 1985). The very notion of the base map suggests the unification of multiple cartographic functions into a single cartographic system, “an epistemological singularity that required that at any *one* time there should be only *one* map of *one* territory” (Edney, 2011, page 78). Scholarship since the 1990s has made it a commonplace that the topographic or base map is not ‘neutral’ or experienced as such (Blomley, 2003; Harley, 1989; Wood and Fels, 1992)). Nonetheless, topography is generally considered to have uniform characteristics and function within a single ‘state-space’. This perspective prevails to the point that the homogenisation of heterogeneous sites and spaces

through topographic mapping has come to be seen as a necessary condition for the genealogy of the 'state-space' or 'territory' (Biggs, 1999; Branch, 2014; Elden, 2013).⁴

Assumptions about the uniformity and ubiquity of state cartography underpin a wide variety of literatures. General treatments of state cartography tend to accentuate the ways in which governmental power is increased through the centralised accumulation of territorial visualisations, and state-determined ontologies of natural resources (Crampton, 2011; Demeritt, 2001; Scott, 1998; Whitehead et al., 2007). Marxist spatial theory brings a vocabulary that is highly-attuned to various forms of unevenness (Harvey, 1982, 2006; Lefebvre, 2009), and might have assisted our understanding of this topography as related to the production of "a differentiated and integrated space economy" (Harvey, 1982, page 375). But this scholarship offers us surprisingly little purchase on differences in the deployment of cartographic visualization.⁵ The *principle* of uniform topographic coverage is also taken up by technical histories of African cartography: which therefore explain unevenness as failure on the part of British colonial regimes due to insufficient governmental resources (McGrath, 1976; Stone, 1995). This explanation clearly falls into the mode outlined by James Ferguson, in which political intent is obscured by narratives of technical inadequacy (1990). The positive choices – which areas *were* mapped – remain naturalised or unaccounted for. It is this challenge, to account for the positive choices, that forces a new approach.

To address that challenge this article proposes the model of a 'cartographic economy'. This work follows the lead of scholars who have cautioned against treating imperial or colonial agencies as monolithic, and demonstrated them to be distributed networks of groups,

⁴ There has been debate over whether colonial mapping practices allowed for, or stemmed from, those of European states but a resultant homogenisation of space is assumed to be similar for both colonised and colonising countries (Branch, 2012; Escobar, 1997).

⁵ The emphasis on the homogenizing quality of mapping has obscured the variety of relationships that modern state-mapping might have to forms of economic activity, the mobilities of capital and of labour. A uniform one is assumed. Genealogically, cartography is seen as the basis for both "the commodification of space *and* the production of new but equally oppressive geographical systems for the containerization of power" (Harvey, 1989, page 258) (my emphasis). The state is considered the progenitor of the 'space' of the space-economy.

77 individuals and influences.⁶ In particular it borrows from an expanding body of work on the
78 representational economies of governance (Agrawal, 2005; Ghertner, 2010; Hull, 2012).⁷
79 Participants in the early twentieth-century Northern Rhodesian cartographic economy
80 included the imperial mapping authorities, as well as the Northern Rhodesian ones; the
81 Northern Rhodesian secretariat; colonial scientific officers; the mining (and other) companies
82 who invested in the Copperbelt during that period; and an early aerial photographic business.
83 For each of these groups topography represented the means to a different end, they had
84 differing resources, and variable leverage.

85 In exploring the history of the 'value' of Northern Rhodesian topography, the article focuses, in
86 particular, on *aerial photography as a cartographic technology*. Critical literature is beginning to
87 address the variety of civil uses of early twentieth century aerial photography (Cronin, 2007;
88 Dyce, 2013; Haffner, 2013; Monmonier, 2002), we are focusing here on its use for mapping for
89 two reasons. Firstly, because as seen by comparing Figure 1 and Figure 2, the production of
90 topography was tightly linked to the deployment of aerial photography. Four aerial
91 photographic projects that were carried out in quick succession between 1927-1931 became the
92 basis of three-quarters of the mapping at 1:250,000 produced by the Northern Rhodesian
93 government *for the subsequent twenty-four years* (Blocks A-D in Figure 1). Secondly, aerial
94 photography was more capital-intensive than traditional land-based surveying methods and as
95 a result it allows us to see the workings of the cartographic 'economy' in more vivid relief.

⁶ This is a large body of work, but expansions of this in relation to colonial knowledge production include (Anderson, 2009; Stoler 2010; Tilley 2011).

⁷ Elsewhere, I have used that literature more closely in examining the intersection between Northern Rhodesian cartography and the spatiality of indirect rule (Author, forthcoming). Here, by contrast, I focus on the value of the topography in directly financial terms. It should be noted that the 'successful' production of topography is less socially complex than the 'successful' production of cadastral cartography and that as such indigenous resistance has much weaker influence on outcome (Braun, 2005; Craib, 2004).

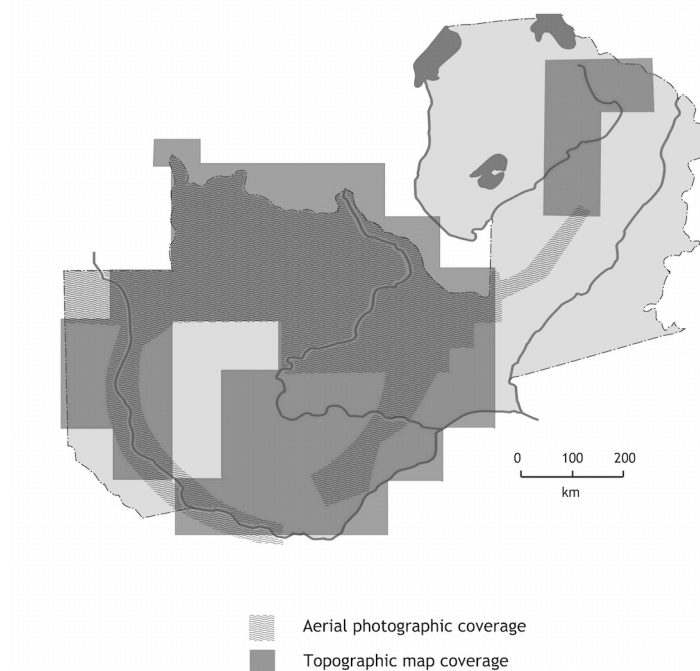


Figure 2: Aerial photography carried out in Northern Rhodesia 1927-1931, against topographic mapping at 1:250,000, 1928-1955 (Pullan 1976; Pullan 1978)

Here we will explore the Northern Rhodesian cartographic economy from three different perspectives. The first section sets out contrasting positions; the role of cartography in a planned 'spatial order' versus its role in the responsive, tactical management of colonial assets. The latter scenario better describes the Northern Rhodesian government's territorial (dis)order, as the foundation for a cartographic economy subject to diverse influences. The second section returns to the focus of previous scholarship on the territorial visualization of Northern Rhodesia - the period 1927-1931 - and the arrival of aerial photography into the colony. This is revealed to have provided an impetus for topographic production, but only transiently. The final section uses the deployment of aerial photography to measure the comparative influence of different parties on the production of a conceptual framework for organizing colonial resources. All three sections reveal a relationship between the perceived value of topography and the anticipated value of territory that was both dynamic and reciprocal.

1.3 The cartographic economy and colonial 'spatial orders'

In histories that consider the *raison d'être* of colonial cartography, the dominant tendency is to see it as a mechanism for overturning pre-colonial spatial practices and establishing a new spatial order. This can be seen strongly, for example, in Matthew Edney's account of the East India

Company's Survey of India (1999); Timothy Mitchell's depiction of cartography in nineteenth-century colonial Egypt (2002); in the dislocation of colonial cartographic principles into Siam as described by Thongchai Winichakul (1994); and more recently Raymond Craib's investigation of modern cartography in Mexico (2004). Whilst technical studies of cartography tend draw out the differences between varieties of maps and mapmakers, contextual studies of late nineteenth- and early twentieth-century colonial cartography tend to frame all government mapping activity within the context of singular, unified outcome: the consolidation of centralised, distanced power. So although, for example, in *Cartographic Mexico* Raymond Craib elaborates a diversity of mapping projects, emphasis is placed on the ways in which successive regimes *intended* to break with the one before, and produce diachronic spatialities or 'fixations' (2004). This tendency has been somewhat compounded by the success of the literature on mapping in South-East Asia where this characterisation of the relationship between cartography and centralised power is particularly apt. Studies of colonial rule in this region have given us evidence of how cartographic practices served the centralised organisation of forestry (Agrawal, 2005; Barton, 2001), the implementation of a cadaster (Edney, 1999; Michael, 2007), and the creation of a cartographic icon that cohered 'an' Indian identity (Anderson, 1983; Ramaswamy, 2001).

Although this literature offers many insights, it is difficult to apply the principles of 'spatial ordering' to Northern Rhodesia. In comparison to other imperial territories, there was little military action against the colonised and the conflicts on its borders during the First World War were not cartographically productive for the colony.⁸ 'Spatial ordering' would therefore need to come from civilian visions for the future of the colony and its resources, but these were not tightly defined. The first years of colonial governance (1890-1924), took place under the British South Africa Company who had inconsistent policies regarding the desirability of white settlement (Slinn, 1971). Under Crown rule, from 1924, there was still hesitation about what best 'to do' with Northern Rhodesia. Initiatives encouraging settler plantations and farming were not fully embraced (Gann, 1964). Further dramatic shifts in governmental policy followed the

⁸ This observation can only be made from the absence of map production by British military forces in Central Africa as recorded in the catalogued output of the War Office. There has been minimal treatment of this region in secondary literature on war cartography (Chasseaud, 2013).

42 sequential discovery and exploitation of different natural resources in the colony, namely teak
43 timber, from around 1911, and then copper from the 1920s. The taxation of Africans on a *per*
44 capita/per household basis was aligned to the organisation of the population as a labour reserve
45 (Meebelo, 1986), but the economic organisation of Africans was not pursued with the rigour
46 demonstrated in Southern Rhodesia or South Africa; an attempt at the geographical
47 segregation of Africans into 'native' areas was enforced only half-heartedly (Gann, 1964; Wills,
48 1985).

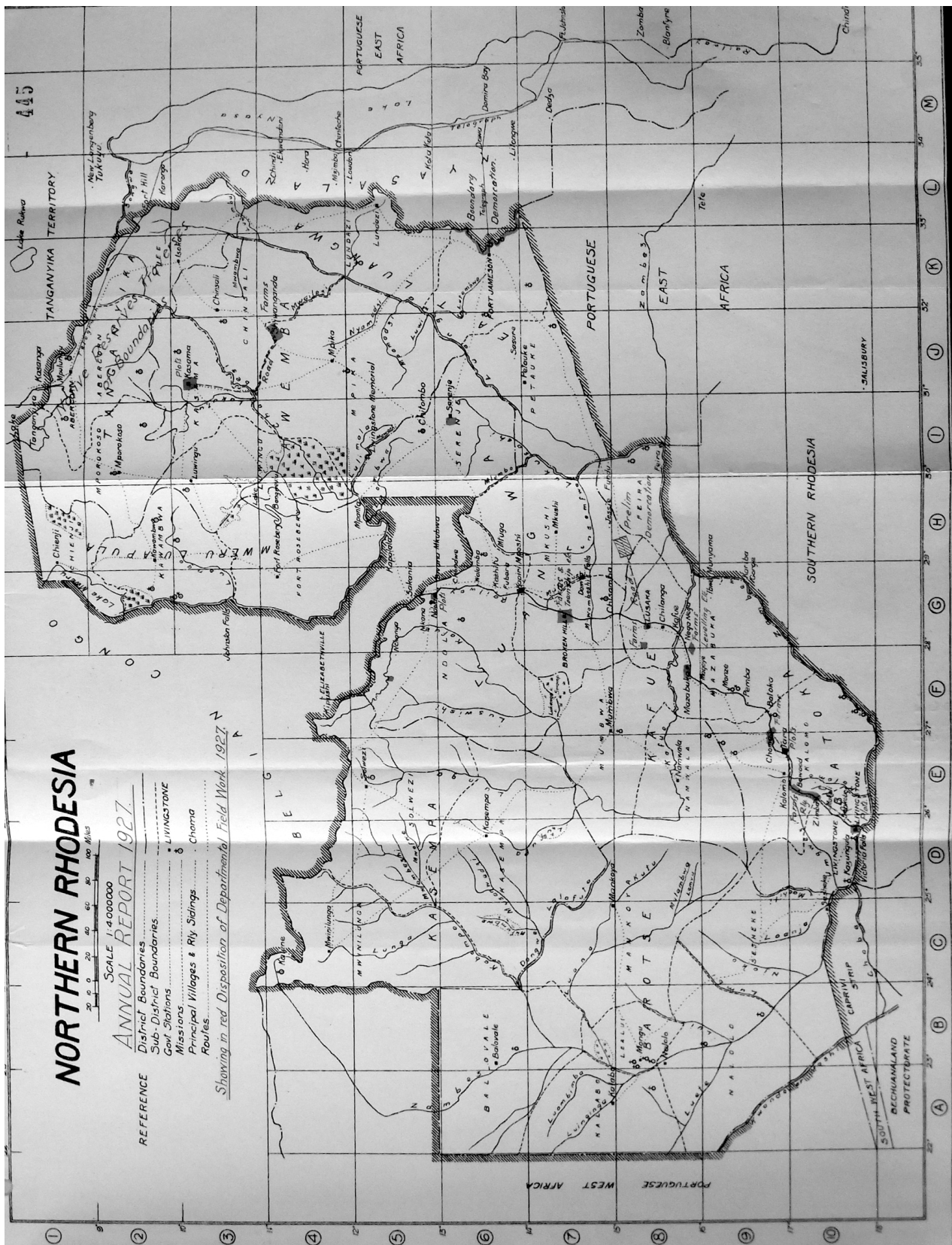


Figure 3: The map of field work carried out in 1926 by the Survey Department of Northern Rhodesia. Areas of field work marked in red (here darker grey), accounted for some boundary demarcation (e.g. 6K), some road measurement (e.g. 8G) and the cadastral survey of farms such as at (7H). (Annual Report, Survey Department of Northern Rhodesia, 1927. National Archives UK CO799/3).

Within this staccato-ed set of policies, governmental cartographic expertise was also fractured. Three major kinds of mapping were undertaken. Geodetic survey and international boundary work were carried out on an exceptional basis by visiting Imperial parties that were funded by London government. By the late 1920s, these parties had produced thin stretches of mapping around the borders of the territory, and a strip of geodetic mapping that followed the 30th Meridian from Southern Rhodesia (now Zimbabwe) to Lake Tanganyika (Donaldson, 2008; Smith, 2006; Stone, 1995). The less highly technical work of 'routine mapping' was considered to be the financial responsibility of individual colonies, and therefore of the local Survey Departments (McGrath, 1976; Stone, 1995). The majority of the Northern Rhodesian Survey Department's time was spent on the cadastral survey of European property, which represented a very small proportion of the total area of the territory.⁹ Topographic survey was carried out on an *occasional* basis during the tours surveyors made to mark out property, and on an *semi-enthusiast* basis by local administrators (Pullan, 1978; Stone, 1982). The earliest results of this work were published between 1917 and 1926 as a provisional 1:250,000 series that putatively covered the whole colony (Pullan, 1978). However, the majority of the data recorded on these sheets was unmeasured, much of it was estimated (rivers represented by dotted lines) and huge expanses were left blank. This can be understood when looking at the annual activity of the Northern Rhodesian Survey Department. Figure 3 shows the work-done in 1927 (the year of the first aerial survey). The department employed nine surveyors. The cartographic coverage that the department achieved that year is represented not by grids or squares but by scattered scrawls of thin inked in-lines, which give some idea of the pace of accumulation of topographic data. Although the expansion of the copper industry in the 1920s and 1930s altered these patterns slightly (the rate of European settlement fluctuated but generally increased), the nature of the mapping by the Northern Rhodesian Survey Department remained largely the same up to 1955.

This slow rate of accumulation led to frustration in some parts. In 1936, when Brigadier Winterbotham, Director General of the British Ordnance Survey, addressed the British Association for the Advancement of Science, he went so far as to suggest that his audience was

⁹ The measures for the alienation of land are not straightforward, because they didn't include land held under concession but only that which was transmuted into private property. By 1955 this still represented a small fraction of the colony, about 7%. See the annual reports of the Survey Department (National Archives UK CO/799) (hereafter NA UK).

183 witnessing a “cycle of indifference [to mapping]”, (1936, page 102). We are not used to accounting
 184 for governmental ‘indifference’ to modern cartography. How should we do so? Retrospectively,
 185 Jeffrey Stone has suggested that British apathy towards colonial mapping in this period
 186 stemmed from confidence in the long-term nature of colonial rule (1995, page 107). This offers
 187 us part of an explanation (a temporal framework for defining cartographic value) but not the
 188 whole. In 1936, Brigadier Winterbotham reached the conclusion that, despite global financial
 189 depression, the imperial government considered itself, “rich enough to survive the handicap of
 190 inadequate mapping” (Winterbotham, 1936, page 102). Whilst his claim was deliberately
 191 provocative, it seems to be closer to the mark.

192 The contextual studies of colonial cartography that speak to ‘spatial ordering’ tend to frame its
 193 economic potential within the aims of a Foucauldian governmentalist state (Crampton and
 194 Elden, 2008). Thus for example, Craib argues that in Mexico in the late 1880s, the government
 195 used cartography to frame the country as a coherent, stable site for investment (2004). For
 196 Mitchell the mapping of Egypt served to render a fiscal landscape more efficiently in the effort
 197 to counter intransigent national debt (Mitchell, 2002). The intensity of cartographic activity
 198 between the years 1927-1931 that we will examine here seems to speak to a ‘gestural
 199 governmentality’ that would blossom into more substantial bureaucratic territorial
 00 management (Hannah, 2000, page 37). However, this is not supported by the longer-term view
 01 of topographic production. On the contrary, when considering the topographic production over
 02 a longer period up to 1955 (Figure 1), it seems that earlier economic attitudes to imperial
 03 territories in tropical Africa prevail, in which it was anticipated that the influx of private capital
 04 would organically produce profit from the innate natural wealth of the continent (Ehrlich, 1973;
 05 Frankel, 1938; Tilley, 2011). I would argue that whilst the patterns of Northern Rhodesian
 06 topography could be seen to reflect political miscalculation or hesitance, they are better
 07 understood as resulting from a temporary injection of capital into mapping, within the
 08 framework of British imperial government in the late 1920s and early 1930s that had an
 09 extremely *laissez-faire* attitude to resource management.¹⁰

¹⁰ The Northern Rhodesian government didn’t do a great deal facilitate *or* regulate independent economic actors. This can be seen mostly clearly in the fact that the colony did not instate a geological

In sum, I propose that the isolated blocks of mapping in Figure 1 do not represent a monolithic, homogeneous spatial order, or the absence of a spatial order, but rather a spatial interest that was *tactical*. Above all, these topographic maps did not anticipate economic activity but were produced in the wake of relatively unregulated commercial activity, *post hoc*. From this perspective, the analytical benefit of the ‘cartographic economy’ becomes clearer. To understand the role of these maps in the history of the colony we need to address the contingencies and specificities of their creation, and the diversity of forces in play. The following sections examine the histories of two sections of topography – *Block A* and *Block D* (Figure 1) – and interrogate the conditions of their ‘tactical’ emergence more closely.

1.4 Timing, risk and the cartographic economy

From the mid-1920s, Northern Rhodesia aroused the interest of international mining corporations. This heralded a great deal of cartographic activity, including the first uses of aerial photography. The mapping was born of three interconnected motives. Firstly, the potential value of deposits required property and concession boundaries to be demarcated at a greater level of precision, thus activating the value of cartographic records: “A country with a valuable mining industry cannot afford to be careless of inches” (Worthington, 1938, page 30). Second was the mapping that facilitated the expansion of related infrastructure, such as roads, townships and hydroelectric schemes. Thirdly, and most importantly, was the mapping related to the discovery of minerals. The nature of the copper deposits in Northern Rhodesia (large, but quite far below the surface, and of quite a low grade) necessitated the identification of wider geological patterns (Bradley, 1952). Thus systematic prospecting and mapping was carried out across vast stretches of territory, to trace underlying strata.

The techniques used to visualise Copperbelt ore have recently been investigated by Tomas Frederiksen (2013). Frederiksen identifies the new intensive and systematic forms of documentation involved in making the copper deposits ‘legible’ to the headquarters of the mining companies in London. This documentation (which bypassed government and went straight to the boardrooms) allowed mining engineer-financiers to decide how to locate

department until 1950 despite the fact that the value of Northern Rhodesia’s mineral exports increased from £52,000 p.a. to nearly £4.5 million p.a. between 1913 and 1935 (Frankel, 1938, page 212).

boreholes, and where to begin exploitation. However, Frederiksen implies that expenditure on knowledge production (which according to retrospective assessments reached £471,181 between 1926 to 1934), can be taken for granted (Bancroft and Guernsey, 1961, page 90).¹¹ I propose that these decisions to invest in territorial visualisation need more careful consideration.

In amongst the mining companies' cartographic expenditure detailed above were the costs incurred by Rhodesia Congo Border Concession Ltd. (RCBC) on hiring the Aircraft Operating Company Ltd. (AOC) to carry out Northern Rhodesia's first aerial photographic survey (1927-1929). This endeavour alone was an enormous investment. There was no air infrastructure in the colony: few planes had ever flown over it, and only a handful of aircraft existed in Southern Africa (Blake, 1971). The planes arrived in pieces from England on a steamer, then travelled by rail and finally motorcar to the RCBC concession (Anon., 1927). With the planes came eight Europeans who occupied an extensive base-camp with several technical workshops, for over a year (McAdam, 1974). It had seemed that the new, two-engine planes would be most appropriate for flying long distances over the flat, bushy terrain, as they would mitigate the risk of engine failure and forced landing (Anon., 1928). However, the RCBC would not wait the several months these planes would take to commission and build. Instead they decided to use single-engine planes, and cut emergency landing grounds right across the concession at twenty-mile intervals (Anon., 1928).

The RCBC's decision to commission aerial photography was not without risk. In 1927 this technology was at an experimental stage. It had been employed for reconnaissance and mapping during the First World War, and in the 1920s was being tested within industrial projects. This had seen most success in Canada where it was supported by a nexus of governmental, military and industrial partners (Cronin, 2007; Dyce, 2013; Matthes, 1926). In the UK of the interwar period, however, there was little government support for aerial photography for either military or civil purposes (Collier, 2002), and its use was principally developed by small commercial interests. These companies had accomplished a handful of projects including timber surveys, route reconnaissance, and prospecting for oil, in Burma, Borneo and South

¹¹ This is almost incomparable to government cartographic activity. The Survey Department's expenditure for the whole year in 1927 was only £5,812 on salaries, and £142 on instruments) (Annual Report, Survey Department of Northern Rhodesia, 1927. NA UK CO799/3, page 490).

64 America (Anon., 1926, 1930), and it was far from guaranteed that the technique would be
 65 successful for copper prospecting in Central African conditions.

66 So why was the RCBC prepared to risk bringing the AOC to Northern Rhodesia? There are two
 67 reasons, both important in understanding the mechanisms of the cartographic economy. First
 68 of these was timing. The RCBC had been granted exclusive prospecting rights, but only for a
 69 five-year period. They were also committed to particular levels of spending in 'developing' their
 70 concession. The Northern Rhodesian authorities included these clauses in their contract in
 271 response to prospecting practices of earlier years, which had tended to be badly funded and
 172 had resulted in disparate claims without strong evidence that would support their exploitation
 173 (Slinn, 1971). So whilst, according to Stone, the Northern Rhodesian government were possibly
 174 experiencing a *lack* of temporal incentive to mapping the colony (1995), the RCBC were under
 175 pressure to realise a profitable future. It was for this reason that the RCBC could not wait for
 176 double-engine aeroplanes to be constructed, and it accounts for their investment not just in
 177 aerial survey, but in several experimental methods that it was hoped would increase the
 178 rapidity and accuracy of their geological investigations (Bancroft and Guernsey, 1961).

179 These time pressures increased the value of visualisations of the concession, but the mining
 80 companies had a second reason to be willing to take the risk: profit was being drawn from the
 181 enterprise at multiple points. Ostensibly, mining engineers were reducing the risk of mining
 182 investment by creating sounder, more reliable knowledge about potential ore-bodies and their
 183 extractability. However, these engineer-financiers were generating revenue for themselves in
 84 the process of assessing that potential; income they could still enjoy regardless of whether
 185 valuable minerals were discovered (Phimister and Mouat, 2003). The value of knowledge *about*
 86 the concession was being produced separately from the value of the *concession itself*. In fact
 187 aerial photography failed as a method of prospecting for copper under these conditions, but the
 88 result of the mining companies' ability and motivation to take risks in the process of visualising
 89 Northern Rhodesian territory was that, after years of disparate activity by the Survey
 90 Department, large stretches of the colony were available to the distanced gaze.

191 Although the colonial government would never have initiated such expenditure, they were
 192 keen to take advantage of the resultant photography. The RCBC was satisfied with the
 193 photographs alone, and the Survey Department didn't have the manpower or expertise to turn
 94 the photography into maps, so they solicited the imperial government for extraordinary funds
 195 to commission the AOC itself to produce topography. The Colonial Office agreed to provide the

96 £6,000 from the recently erected East Africa Loan Scheme to fund the private production of
 97 topographic maps of *Block A* (Figure 1) (Annual Report, Survey Department of Northern
 98 Rhodesia, 1927. NA UK CO799/3).

99 A high-capital cartographic technology had arrived in Northern Rhodesia because the
 00 government had imposed time limits on the investigation of the concessions; now the time
 01 pressures were returned onto them. The AOC were keen to do as much business as possible
 02 before they left the region. The company campaigned vigorously in 1927 and 1928 for more
 03 photographic commissions (McAdam, 1974). Using the classic pitch (key to double-glazing sales)
 04 that the costs would be lower *whilst they were in the neighbourhood*, the AOC provided
 05 motivation for organisations to find partners who would share the costs of further projects.

06 Between 1927 and 1931 this included four ‘extensions’ to the RCBC aerial photography,
 07 commissioned by the Northern Rhodesian government; most of which was funded by loans
 08 authorised by the Colonial Office, but partly by other private interests. These extensions
 09 resulted in further topography. The first photographic extension (source for the map sheets of
 10 *Block B* on Figure 1) extended the coverage of the Copperbelt. The second (map sheets in *Block*
 11 *C*) was subsidised by Robert Williams Co. Ltd., who wished to incorporate the transportation
 12 potential of the Upper Zambezi into their rail network. The third (map sheets in *Block D*) –
 13 which we will discuss in the next section – documented the profitable farmland along the line
 14 of rail. Finally the Northern Rhodesian government also commissioned air photography of six
 15 townships (lying within these other areas) (Pullan, 1976).

16 By 1929 one-fifth of the territory was photographed (*Annual Report, Survey Department of*
 17 *Northern Rhodesia*, 1929, 435, CO799/5, NA UK), yet the regular cycle “of indifference” and *post*
 18 *hoc* practice, had not been broken. Each of these projects were financed by extraordinary funds,
 19 and each diversified the participants in the Northern Rhodesian cartographic economy. The
 20 Northern Rhodesian government had *temporary* access to aerial photography as a cartographic
 21 technology. This solution would have been unavailable without sources of more fluid finances
 22 being made available. Without the exceptional financing for aerial photography, the annual
 23 records of topographic work of the years 1928-1935 would have most likely resembled the sparse
 24 lines shown in Figure 3.

25 By detailing the influence of investment, risk and time pressure on the value of Northern
 26 Rhodesian topography in *Block A* we begin to see what levels of complexity are disguised by

idea that topographic maps cohere to ‘one map of one territory’. We have seen that the value of topographic mapping was affected by government policy on concessions, the financial structure of the mining industry, and the interests of the AOC. The following section, which recounts the history of the production of the topographic maps in *Block D* (Fig. 1), reveals more about the role of different parties in actively manipulating the conceptual frameworks for the ‘rational’ assessment of colonial resources.

1.5 Ecology, economy: the rhetorics and reality of colonial resource management

Examining the history of the third section of topography *Block D* allows us several further insights into the cartographic economy. Firstly, it unravels the separate interests of a triumvirate of colonial presences in Northern Rhodesia; the colonial scientific officers, the colonial secretariat and the AOC. Secondly, it allows us to see the role of the AOC at work in shaping the value of ‘inscribed’ territory for both the scientists and secretariat of Northern Rhodesia.

Recent histories that have treated aerial photography in Northern Rhodesia have variously conflated these groups. The AOC usually features as a tool—innovative and clever, but fundamentally inert—that state scientific experts worked to their own ends. The scientific experts, on the other hand, are credited with using both the content of the images and the techno-rhetoric of aerial photography to promote their interest in environmental systems and relations. This confusion can be seen in how the work of Ray Bourne is narrated. Bourne was an envoy of the Imperial Forestry Institute, sent by the Colonial Office to Northern Rhodesia in 1928 to investigate the timber potential of the expansive forests in the colony. Peter Adey describes him as driving the use of aerial photography in Northern Rhodesia for forestry, a means for the Northern Rhodesian government to open the territory up “to the distanced gaze for the imposition and projection of power and reach” (2010, page 86). In Helen Tilley’s *Living Laboratories*, Ray Bourne “seized the opportunity of demonstrating the value of employing aerial survey” (2011, page 144). Elsewhere in *Imperial Ecology*, Peter Anker linked Bourne’s presence to the goal of establishing clear political boundaries (2001, page 83).

Although Bourne was enthusiastic about aerial photography, in his own words it ‘happened’ that the AOC was in the field carrying out the project for the RCBC (1928, page 8). Yet he has consistently been seen to epitomise the proactive state inscription of natural resources and territory. We can see from the previous section that these narratives displace both the primacy of the copper industry in bringing the AOC to Northern Rhodesia, and the energetic propagation of aerial photography by the AOC themselves. Those authors have also mis-assigned the agency of colonial scientists *within* government. The history of the mapping from air photography in *Block D* gives us insight into the failure of the rhetoric of rational resource management to vanquish short-term tactical attitudes to resource exploitation.

The aerial photography behind the maps of *Block D* resulted from work carried out for the Agricultural Survey Commission in 1929 (Pullan, 1976). The purpose of the Commission was to consider how the farmland along side the line of rail should be distributed to settler farmers (Memorandum, Chief Agriculturalist, Northern Rhodesia, April 1932. National Archives of Zambia MAG2/9/5).¹² This allocation had, (somewhat like the early prospecting) been proceeding in a relatively *ad hoc* manner. The outcome, it was suggested in 1926, was detrimental both to agricultural production and to colonial societal fabric (Annual Report, Survey Department of Northern Rhodesia, 1926. NA UK CO799/2). As the mining industry grew rapidly at the end of the decade, this problem gained a further intensity; food supplies needed to be secured for the miners (Governor of Northern Rhodesia to the Colonial Office, April 4th 1929. NAZ MAG2/7/3). The Commission was keen to discover “the best manner in which [the land] should be divided into farms of economic acreage,” (Chief Secretary, Northern Rhodesia, to the Deputy Commissioner, Trade and Information Office of Great Britain, 29th September, 1930. NAZ MAG2/9/1), primarily in relation to transport and hydrography. A strip of aerial photography that ran 15 miles each side of the railway was provided by the AOC to assist them in this task.

In 1931, a second set of aerial photographs of railway-belt land was produced. This was not a commissioned project, but an initiative of the AOC themselves. The air and groundwork were carried out single-handedly by Captain Charles Robbins, an employee of the AOC (*An Experiment in the Classification of Land with the Use of Aerial Photographs*. C. R. Robbins, 1932. NAZ MAG2/9/3). The project was intended to extend the market for the AOC’s work by proving the

¹² National Archives of Zambia hereafter ‘NAZ’.

potential of aerial photography for the classification of soil types. It was recorded that Robbins felt that, “the local authorities, particularly the Agricultural Survey Commission were not making full use of the air photographs available” (R. Bourne to the Under Secretary of State for the Colonies, 14th August, 1933. NAZ MAG2/9/5). As a result Robbins was, “determined to show the possibilities of such a method conducted exclusively by his company”, which was described as, “a freak performance for demonstration purposes, and, as such the most remarkable one-man effort I have ever studied” (Memorandum, Chief Agriculturalist, 1932. NAZ MAG2/9/1). The illusion that this was innovative government science, rather than a theatrical sales endeavour, was deliberately fostered by the AOC. They astutely called the project an “experimental aerial ecological survey” (*An Experiment in the Classification of Land with the Use of Aerial Photographs*. C. R. Robbins, 1932. NAZ MAG2/9/3). Robbins’ account of the project published in the *Journal of Ecology* follows a strategy that the AOC used elsewhere in their publicity: framing experimental projects as a successful response to pre-existing government demand (Cochran-Patrick, 1931; Robbins, 1934). Thus, Peter Anker and Helen Tilley have read the ‘ecological’ in bolder terms than is perhaps just, when they set the use of air survey within the narrative of the growth of ecological attitudes within colonial science (Anker, 2001; Tilley, 2011).

Robbins’ exercise shows that the AOC were keen to extend their services to the interpretative aspect of aerial photography, but the company were following this ambition through in a number of ways. They were also increasing in-house expertise, and building a network of contacts within the fields of forestry, geology and “general economic development” (Anon., 1929b, page 1343). The interdisciplinarity of the AOC’s product was more usually promoted as an ‘economic survey’ than an ecological one (Anon., 1929a, 1929b; Crosthwait, 1930). Their eagerness to promote their services via the organs of scientific societies, was matched or exceeded by their activity in responding to debates about the role of colonial resources in solving British unemployment questions. According to the AOC, aerial photography could increase understanding of those resources, decrease the risk to those considering emigration, and decrease the cost of trade through a better siting of production and transport

infrastructures (Anon., 1929a, 1929b; Crosthwait, 1930). For example, in 1930, in response to an imperial report on the scale and structure of the political units of East Africa, Herbert Crosthwait, Director of the AOC prepared a paper for the Royal African Society, expounding the value of an “economic survey, for which maps are necessary”, and without which potential projects would founder in “imperfect and ill-digested information” (1930, pages 333–334).

‘Economic survey’ was a term that could be applied to just about any of the work that the AOC were commissioned to do, and was generally used to emphasise the reconnaissance aspect of the air photography over that of providing detailed or precise measurements. Most importantly, it was more flexible term than the ‘ecological’ survey. It could cede non-problematically to less rigorous epistemological principles.

The topographic outcome between 1928 and 1955 (Figure 1) suggests that the patterns of the ecologists’ interests, and priorities had little influence on Northern Rhodesian policy more broadly. ‘Economic’ rather than ‘ecological’ thinking won the day. The government scientists in Northern Rhodesia built most of their knowledge from decades of traverses by foot and automobile (Wigg, 1949). Elsewhere in the colony, when scientific officers attempted investigations, they didn’t have even provisional base maps and had to sketch their own *ad hoc* substitutes (*Summary of Work: Mankoya and Lealui Districts. Forestry Officer for Barotseland*, J. Martin, 1939. NAZ SEC1/975). It was the skill of the AOC to be able to marry the contradictory positions represented by the rhetoric of holistic decision-making frameworks and scientific planning, and the reality of government interest in visualising isolated, profitable areas. The ‘economic survey’ of the AOC, was (in the words of Captain Robbins) in fact offering the possibility to, “*Eliminat[e]... those areas which... were of lesser economic interest... [confining the] labours of expert investigation to those areas more likely to yield profitable results [so that each would receive] attention in direct proportion to its importance*” (emphasis added) (*An Experiment in the Classification of Land with the Use of Aerial Photographs*. C. R. Robbins, 1932. NAZ MAG2/9/3).

The original model of a neoliberal governmental regime describes state observation techniques being deployed for the purpose of *deciding the appropriate level* of state intervention (Foucault, 2009; Osborne, 1996). However, it is hard to see how the Northern Rhodesian attitude towards

topography might reflect these goals for data collection. The ‘importance’ of an area of territory was almost always determined in advance, and under fairly aleatory circumstances. This is perhaps not surprising, it could in fact be expected that twentieth century cartography might compound rather than alleviate ‘uneven development’. However, in the case of Northern Rhodesia, insufficient analysis of the difference between the values of the ‘ecological’ and ‘economic’ surveys; and the failure of existing studies to identify the influence of commercial interests in shaping cartographic production have obscured this perspective. As a result the rhetoric of the importance of holistic territorial visualisation to rational resource management has been taken somewhat too seriously. In considering colonial cartography more broadly, that rhetoric should be treated with caution.

Conclusion

These histories of the uptake of aerial photography and the progress of colonial mapping are particular to Northern Rhodesia, but the model of a cartographic economy has viability elsewhere. Although the high-capital nature of aerial photography highlights questions of investment and value, all forms of territorial visualisation (including traditional land-based survey) are based on anticipated returns. As Edgar Barton Worthington suggested in his 1938 review, *Science in Africa*, “Survey work, like other branches of development, should be financed by pledging the future” (1938, page 35). The intermittent reviews of African cartography from throughout the twentieth-century suggest the variety of commitments that were ‘pledged’ in the production of topography. The imperial policy of assigning responsibility for ‘routine mapping’ to local colonial survey offices means that the history of each of these will be somewhat different. Each territory saw shifting rates of colonial interest and capital investment (whether through settlers, plantation farming or mineral extraction). Patterns in mapping reflect the prevailing institutional and technological cartographic capacities at peak moments of interest.

If we don't take the value of topographic mapping to be self-evident, or its action to necessarily be ‘homogenising’ then we can begin to find more complex causal explanations for the patterns that can be observed in the case of early twentieth-century Northern Rhodesia. The model of a

cartographic economy has delivered four conclusions that are occluded by earlier studies. First of these is that the short period between 1927 and 1931 represents a transient moment during which topographic mapping was produced as the result of temporary circumstances that united different groups with divergent interests. Second is that the influences on the production of topography in Northern Rhodesia were relatively decentralised. Third, the value of governmental topography was not fixed, but could be 'produced' through various mechanisms – including the imposition of timeframes on resource exploitation, or the availability of technologies. Those timeframes could be manipulated in favour of those who profited from mapping projects. Finally, focusing on governmental scientific offices (including cartographic ones) might tend to discover an ambition to produce complete and homogeneous territorial representations. Yet what we have learned from more rounded histories of colonial agricultural science or anthropology applies equally to colonial knowledge of territory: ambitions were not necessarily shared across governmental authorities. Colonial epistemological positions were operated within tactically, by variety of parties.

Cartographic heterogeneity was more than an incidental effect of colonial rule. We need finer vocabularies to describe how cartography might serve to enable and to regulate social activity, and to differentiate between its usage within various forms of governmental and profit-making regimes. This would allow us a better grasp on the role of mapping in the evolving spatialities of post-independence Zambia, and beyond.

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